

promised to remove the Barrackpore menagerie to the new site as soon as the necessary preparations were made. All the native princes, nobility, and gentry subscribed liberally towards the proposed gardens—for instance, the Maharajah of Burdwan gave 3,000*l.*; others followed this liberal example, and the greater part of the required capital of 30,000*l.* was quickly raised. Such rapid progress was made that occasion was taken of the Prince of Wales's presence in Calcutta on December 27, 1875, to inaugurate the new institution. His Royal Highness expressed his gratification at the results already achieved, praised Mr. Schwendler for the public spirit he had displayed, and accepted the patronship of the gardens.

The Royal Zoological Gardens of Calcutta thus inaugurated were opened to the public for the first time on May 6 of last year. From that date up to the close of the year more than 50,000 persons had visited them, without including members and donors, and soldiers with their wives and children who have a free entrance. The buildings are, of course, yet far from complete, but amongst those finished are, as we are informed, many deer-paddocks, which are already well tenanted; a large and several smaller aviaries, also well filled; a large bear-house in three compartments, and furnished with a large bath; two monkey-houses, and a very large pit fitted up for the residence of rhinoceroses. Within the gardens is also a large tank or lake, with two islands used for water-fowl, and a restaurant and keepers' dwellings have likewise been erected.

At the present time Mr. C. T. Buckland, C.S., is the president of the Association for the maintenance of the gardens, and Dr. J. Anderson and Mr. H. M. Tobin have the general superintendence and honorary care of them, the paid officials consisting of natives only. A European director was appointed in January, 1876, but the Government of Bengal were shortly afterwards stopped by the Supreme Government from contributing to the expenses of the gardens, and his services had consequently to be dispensed with.

This change of front in the Supreme Government, who had virtually pledged themselves to assist in the scheme, and who have not yet redeemed their promise to transfer the Barrackpore menagerie to the new gardens, is a subject of not unnatural complaint on the part of the committee, who are now striving hard to have matters replaced upon their former footing. As the Indian Government keep up botanical gardens in Calcutta, and pay a scientific officer a liberal salary to superintend them, they would surely be fully justified in treating the Zoological Gardens in the same way, especially until the new institution is fairly set a-going. Living animals, as we all know, are far more attractive to the general public than living plants, and there can be no question, we believe, that in Calcutta, as in London, zoological gardens are more popular than botanical. The public of Calcutta have come bravely down with a sum of 30,000*l.* to set the institution going, and will be greatly disappointed if the Government do not support them. A scientific director for the establishment is an absolute necessity, as it cannot be expected that Dr. Anderson and others who now manage it can continue their gratuitous services. Lord Northbrook is now earning his well-merited repose in this country, but looking to the countenance and favour that he has already shown to the Zoological Gardens at Calcutta, we cannot doubt that he will assist in the appeal that is, we understand, now being made to the authorities at home, to obtain permission from the Government of Bengal to continue the support which it gave at first. We may also fairly call upon Lord Salisbury, who has on many occasions shown his appreciation of scientific work, to devote a few minutes' attention to this subject. It is certain that no better step could be taken for the advancement of Zoological Science in India than the establishment of the Zoological Gardens of Calcutta on a firm footing. Like our Gardens in London they might

easily be made a centre whence encouragement is diffused to zoological investigations of every kind. A well-selected director, appointed and paid by the Government, would at once place matters on a satisfactory foundation, and tend to bring together support to the Institution from every quarter, and we cannot doubt that the present obstruction will be removed by the Central Authority as soon as the real facts of the case are brought before them.

#### OUR ASTRONOMICAL COLUMN

DOUBLE-STAR MEASURES AT CINCINNATI.—In Nos. 2 and 3 of the publications of the Cincinnati Observatory are two series of micrometrical measures of double-stars made with the 11-inch Merz refractor. The first series includes measures by Prof. O. M. Mitchell at the old Observatory, confined, with few exceptions, to the stars of the great Dorpat Catalogue, and made in the years 1846-48, a small number of which only had appeared in the *Sidereal Messenger*.—The second series comprises measures of objects situated for the most part beyond Struve's limit of south declination made in the years 1875-76, and will probably be found the most useful of the two, observations of these southern stars being as yet in small number. Mr. Ormond Stone, the present director at Cincinnati, remarks that "no systematic survey of the southern heavens similar to that made by Struve of the northern heavens has ever been undertaken," and a large proportion of Sir John Herschel's doubles have never been properly measured micrometrically. The Cincinnati object-glass having been refigured by Alvan Clark during the last winter, the director purposes devoting the instrument to supplementing the labours of other astronomers by measuring double-stars between 15° and 35° of south declination; no doubt in the course of this work new binary systems will be detected.

Amongst the stars in the second of the above series, is  $\lambda$  2036, the duplicity of which was first remarked by Sir John Herschel with the 20-foot reflector in sweep 307 (1830, Oct. 15), when the position was registered 53°0, and the estimated distance was 2". The last Cincinnati measures give for 1876.78, position 26°4, distance 1".64, and Capt. Jacob's intervening measures at Poona and Madras, confirm the retrograde motion in the angle; indeed, he first pointed out the probable binary character of the star, and also suggested another noticeable feature, viz., the apparent variability of both components (Mem. R.A.S., vol. xxviii, p. 41). A comparison of the whole of the estimates of magnitude to 1876, is certainly confirmatory of Capt. Jacob's suspicion. The stars have not been noted as differing more than half a magnitude, and generally have been considered of equal brightness, yet the estimations vary from 6.7 (Jacob 1857) to 9.0 (Ormond Stone, 1875). The object is well within reach in this country, and deserves watching. It may be remarked that the N.P.D. given in Sir John Herschel's fifth series of measures with the 20-foot reflector, is 1° too small. By an observation in the Washington zones, the position for the beginning of the present year is in R.A. 1h. 13m. 54.7s., N.P.D. 106° 26' 15".

CHANGE OF COLOUR IN  $\alpha$  URSÆ MAJORIS.—Herr Weber continues his observations upon the colour of this star, a periodical change in which from intense fiery-red to yellow was first suspected by Dr. Klein of Cologne about fifteen years since. According to Herr Weber the change is from fiery-red to white or slightly yellowish white. The following are recent observed epochs of red light:—1876: September 5, October 10, November 14, December 21. 1877: January 16, March 23, whence an average period of thirty-three days is indicated. The star was white or nearly white, 1876: October 28, December 30. 1877: February 8 and March 13. The star is said to remain red or reddish for a shorter time than it is seen white or yellowish white. See *Astron. Nach.*, Nos. 2,111 and 2,127.

**α CENTAURI.**—The measures of this star which have lately appeared in NATURE show that we are yet without any satisfactory orbit, and it is much to be desired that it may be closely watched during the next few years. Mr. Gill it is understood intends to establish a good epoch in the autumn with Lord Lindsay's heliometer at Ascension. It does not appear to be too late to secure measures which will possess the greatest interest in the actual near approach of the two fine stars forming this splendid binary.

**THE PRESENT COMETS.**—Elements of Winnecke's comet of April 5 calculated by Dr. Plath of Hamburg, upon the same extent of observation as those of Mr. Hind, published in this column, last week, are almost identical therewith, and consequently negative the idea of ellipticity of orbit, notwithstanding the certain degree of resemblance with the comets 1827 II. and 1852 II., and near equality of intervals. On May 14 the comet approaches within  $10^\circ$  of the pole of the equator, near the  $5\frac{1}{2}$  m. star, B.A.C. 1211. It will be visible with telescopic aid some weeks longer.

We subjoin positions of the comet discovered in America by Mr. Lewis Swift on April 11, and by M. Borrelly at Marseilles three nights subsequently, also calculated by Dr. Plath.

For 12h. Berlin M.T.									
		R.A.			Decl.		Log. distance.		
May	10	...	6	8 18	...	+56	7'0	...	0'1243
„	12	...	6	27 1	...	54	22'5	...	0'1275
„	14	...	6	43 53	...	52	30'2	...	0'1315
„	16	...	6	59 5	...	50	32'1	...	0'1362
„	18	...	7	12 46	...	48	30'3	...	0'1417
„	20	...	7	25 2	...	46	25'9	...	0'1479
„	22	...	7	36 11	...	44	21'8	...	0'1545
„	24	...	7	46 15	...	+42	17'7	...	0'1617

M. Wolff, of the Observatory at Paris, observed the spectrum of Winnecke's comet on the morning of April 11, which he found analogous to the spectra of various comets he had observed since the year 1868, from the faintest to the brilliant comet of Coggia in the summer of 1874. All have exhibited the three bands, yellow, green, and blue, but M. Wolff remarks that the nature of this cometary matter is completely unknown. He did not succeed in obtaining the spectrum of the third comet of the present year, in which, like several other observers, he noticed a resolvable appearance.

### BIOLOGICAL NOTES

**ZOOLOGICAL CLASSIFICATION.**—In a recent paper in *Pflüger's Archiv*, M. Hoppe-Seyler wonders at the readiness with which systematic zoology has ranked amphioxus with the vertebrates, from mere one-sided consideration of the presence of a *chorda dorsalis*, and the position of the nerve-cord above, and the alimentary canal below. A sound system groups species which are similar not merely in morphological respects, but in their whole organisation. Amphioxus has, beyond the chorda, nothing in common with vertebrates; it has no closed vascular system with red blood corpuscles, no liver which forms a gall, no proper brain, and it contains no gelatine-yielding tissue, which occurs in all vertebrates and also in the cephalopoda, but in no other invertebrata. In their entire highly-developed organism, the cephalopoda stand nearest to the vertebrata; the amphioxus should have a place further down. M. Hoppe-Seyler further points out that comparing the composition of tissues from the lower organised animals upwards, we meet first with mucin yielding tissues, then with those yielding chondrin, then, in the cephalopoda tissues yielding glutin; the formation of actual bones does not occur in all vertebrata, and is likewise wanting in cephalopoda. Exactly the same order is seen in the stages of development of an embryo, e.g. of the hen in the egg, and it is difficult to think that the agreement is accidental.

**LUMINOUS CAMPANULARIÆ.**—The late Prof. Paolo Panceri recently made minute researches at Amalfi, near Naples, with a view to determine the exact seat of the light-giving organs in Campanulariadae. The Gulf of Amalfi seems to be a favourite haunt of these minute animals, and Prof. Panceri found them abundantly on the algae covering the rocks near the shore, particularly upon *Fucus ericoides*. The light of these polyps is intermittent, and only appears when the animals are touched or moved; fresh water, however, has the property of fixing it for a little time. It was principally with species of *Campanularia flexuosa* that Prof. Panceri made his interesting investigations, and the special question he wished to decide was whether it is the external cellular stratum (or ectoderm), or the internal one (endoderm) of which these animals are composed, which is the actual seat of the light. He found, by means of ingenious microscopical contrivances that the luminous movements of these polyps have their seat in the cells of the ectoderm, and not elsewhere, and that these cells alternately and successively show the light and again become dark, after being touched or placed into fresh water. Not only the bodies of the polyps, but also their slender stems and even the feet with which they adhere to the plants or rocks, contain these luminous cells. Prof. Panceri has published an account of his researches in the January part of the *Rivista Scientifico-industriale*.

**RESPIRATION IN FROGS.**—Mr. A. C. Hoimer has sent us an account of some interesting observations he has made on the spawning or deposition of ova in the frog (*Rana temporaria*). We are only able to give the conclusion of his paper:—I will now give a few facts connected with respiration which I have observed in these frogs. They can croak when they are immersed under water, but, as no air-bubbles escape, I was at first puzzled. I find, however, by holding my nose and shutting my mouth, that I can make a somewhat similar sound; but they seemed to croak louder when only the head and upper part of the body were under water than when their whole body was immersed, and as they distend their sides in the act of croaking, I thought it possible they might be able to draw in air by the rectum or the pores of their skin. When a frog out of water is touched suddenly, he shuts his eyes and distends his abdomen, and the same thing occurs when under water. Yet how is it that they can distend their abdomen without admitting more air? for they can distend it very fully, and I should think must require to expel all the air from the thoracic into the abdominal cavity. When a frog is under water, his sides sometimes pulsate rhythmically, just as when he is out of water, and about every ten seconds. Perhaps it is connected with the circulation of blood.

**THE WOODPECKER.**—In the April session of the German Ornithological Society Prof. Alton concluded the recital of his investigations on the habits of the woodpecker. The peculiar drumming sound often caused by it was shown on various grounds to be entirely disconnected with the search for insects as hitherto supposed, and was regarded as a call to the opposite sex. Dr. Brehm defended the woodpeckers against the charge of seriously injuring the trees, and considered the slight damages resulting from them as more than compensated by the colour and animation which they gave to the otherwise sober and quiet forests.

**THE FLAMINGO.**—At the same session Herr Gadow stated that by a study of the digestive organs of the flamingo he had found that it did not belong to the duck family as hitherto classified, but was to be placed among the storks, being very closely allied to the latter, although properly an intermediate link between the two families.

**COPPER IN THE BLOOD.**—The presence of copper in the blood of human beings and domestic animals has been placed beyond doubt by the investigations of various chemists, but has gene-